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Volcano-Independent Seismic Recognition: detecting and classifying events of a given volcano using data from others

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Modern seismic networks provide a huge amount of data received in real-time, being impossible the manual identification of relevant events useful to monitor the activity of the volcano. Thus, many volcano observatories are interested in tools to perform an online, automatic analysis of the seismic activity.

Machine Learning area provides various of Volcano-Seismic Recognition (VSR) systems designed to classify seismic events in real-time. However, only a few approaches can also detect them in a continuous data streams. Most of those VSR systems are based on the 2-step supervised paradigm:

1. A training database (X-DB) of a given volcano 'X' is prepared with hundreds of events manually detected and classified according to their physical origin.

2. Statistical models are built analysing this DB, and are later used to automatically identify events in new data recorded at the volcano X.

This supervised procedure is the major drawback to achieve a fast deployment of a VSR system for another volcano Y, as the preparation of its own Y-DB takes considerable time, and requires qualified operators and previous recordings, which is difficult for volcanoes without recent activity or which haven't been monitored.

In order to overcome these limitations, the EU-funded project 'VULCAN.ears' focused on real-time, Volcano-Independent VSR (VI.VSR) approaches. It proposes alternative solutions based on state-of-the-art technologies as universal DBs and models, waveform standardisation and parallel architectures.

Recent results obtained by mixing DBs from Popocatépetl, Colima, Deception and Arenal active volcanoes will be presented. We apply VULCAN.ears technologies to evaluate VSR systems on joint DBs built with data of several volcanoes. We also use volcano-independent models to automatically classify events of another volcano, analysing how the recognition accuracy varies as the training DB becomes more complex. All tests are carried out by an easy to use, user-friendly graphical application (geoStudio).

All these achievements produce new insights useful to redesign the next-generation, portable and robust VSR systems.